

New and noteworthy moss records for Turkey and Southwest Asia¹

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Abstract

Following a recent bryological foray to northern Turkey *Rhizomnium striatulum* (Mitt.) T.J.Kop., *Leucodon coreensis* Cardot and *Leucobryum bowringii* Mitt. are reported new to Turkey, the Mediterranean and Southwest Asia. *Cyrtomnium Holmen* is a new genus record for Turkey and Southwest Asia and *Cyrtomnium hymenophylloides* (Hübener) T.J.Kop. a new record for this region. Illustrations, ecology, geographic distribution and brief comparisons with morphologically similar taxa are given.

Introduction

Field studies in recent years have added more remarkable taxa to the bryoflora of Turkey (Batan and Özdemir 2013a, 2013b; Batan et al. 2013a, 2013b; Kirmaci and Kürchner 2013; Uyar and Ören 2013; Yayıntaş 2013; Ursavaş and Çetin 2014; Abay and Keçeli 2014). The new records bring the total number of bryophyte species recorded for Turkey as close to 1000. When compared with most European countries, the bryophyte flora of many regions of Turkey is still either poorly known or completely unknown. On the other hand, Turkey has more bryophyte taxa than any other country in Southwest Asia.

There are considerable differences in geography and climate in the many regions of Anatolia (Turkey). Turkey has three main floristic regions: Euro-Siberian, Mediterranean and Irano-Turanian. Diverse conditions in these regions provide a multitude of habitats which support a rich bryophyte flora. In this study moss specimens were collected at Ordu in the Black Sea Region of north-eastern Turkey (Fig. 1). Ordu is situated within the Euxian section of the Euro-Siberian floristic region which has an eastern Black Sea oceanic rainfall regime with no dry season. The mean annual maximum temperature in the Ordu region is 27.5 °C (in August), with mean minimum temperature equal to 3.9 °C (February). The mean precipitation per year is 1029.2 mm, the highest precipitations occur in October and December and the lowest in May and July (Akman 1999). The Black Sea Mountain range belongs to the North Anatolia of Turkey.

The central and eastern parts the range is high, and lies close to the Black Sea. On the North side of these mountains, the streams and rivers cut deep gorges and flow down to the sea. The moist climate in this region supports the largest tracks of closed forest in Turkey. Ordu has generally rough topography. There are also some plateaux at high altitudes, chiefly Çambaşı, Turnalık, Perşembe, Düzoba, Keyfalan, Topçam, Korgan,

¹This paper is dedicated to Elizabeth Anne Brown (1965–2013), remembering her contributions to Bryophyte taxonomy.

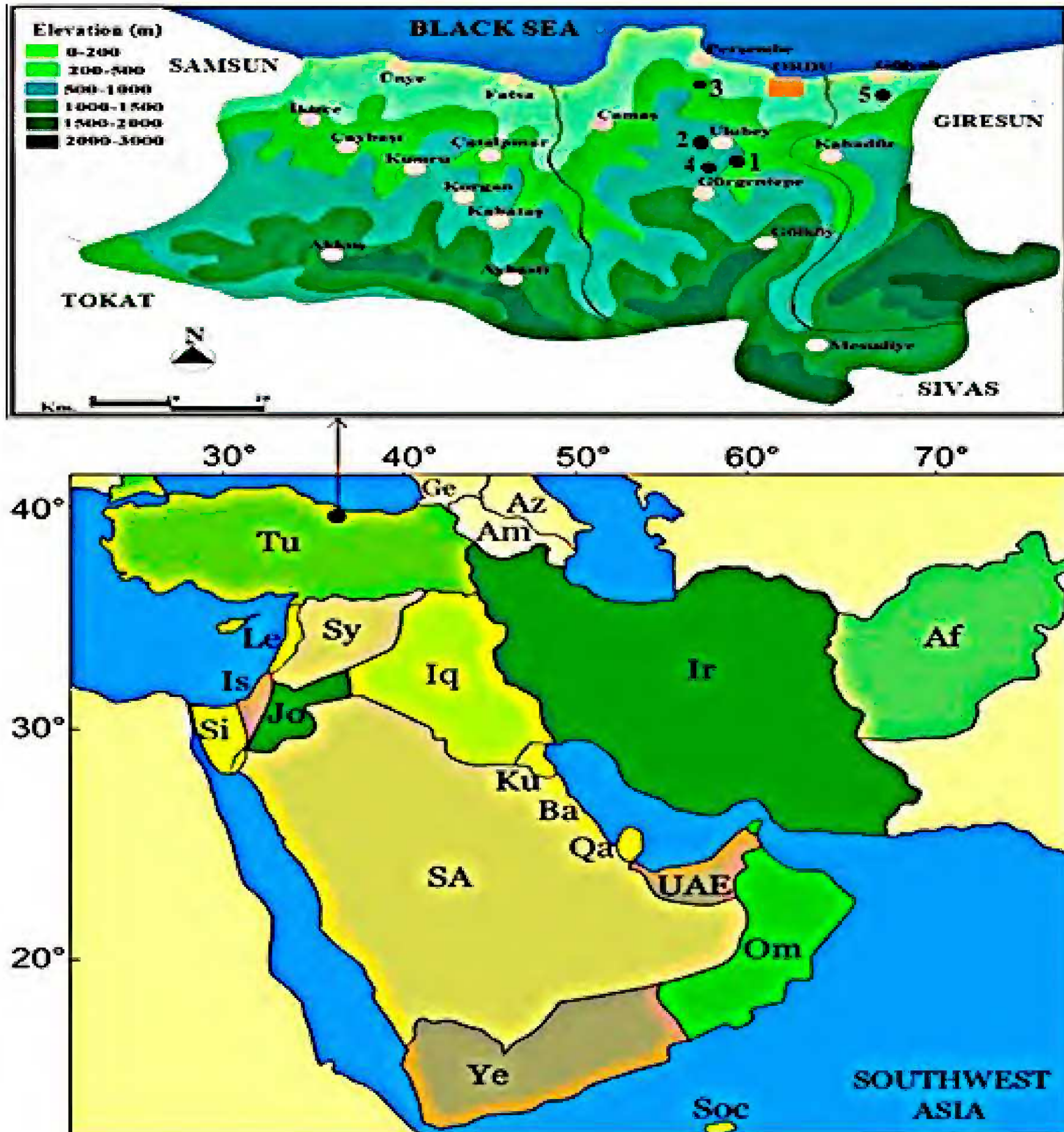


Fig. 1. The position of Turkey in SW Asia and the collection sites of reported taxa in Turkey. Abbreviations: Af: Afghanistan; Am: Armenia; Az: Azerbaijan; Ba: Bahrain; Ge: Georgia ; Ir: Iran; Iq: Iraq; Is: Israel; Jo: Jordan; Ku: Kuwait; Le: Lebanon; Om: Aman; Qa: Qatar; SA: Saudi Arabia; Si: Sinai Peninsula/Egypt; Soc: Socotra/Yemen; Sy: Syria; Tu: Turkey; UAE: United Arab Emirates; Ye: Yemen.

Sarıçiçek, Çukuralan and Cüre. At elevations of up to 1500 m, there are deciduous trees of *Alnus glutinosa* (L.) Gaertn., *Carpinus betulus* L., *Castanea sativa* Mill., *Fagus orientalis* Lipsky, *Quercus* spp. and shrubs such as *Rhododendron ponticum* L., *R. luteum* Sweet., *Laurus nobilis* L. and *Corylus* spp. prevail. *Corylus* spp. are important crop plants as well. At 1500-1900 m the forest consists of *Picea orientalis* (L.) Link. together with *Pinus sylvestris* (L.). Above 1900 m alpine meadows are dominant (Atalay 1994).

There have been no previous bryological studies in the Ordu province of Turkey and until now, this region has remained largely unexplored. Our research is the first bryological study to be undertaken in the region and is thus an extremely important contribution to the moss flora of Turkey and Southwest Asia.

The genus *Cyrtomnium* Holmen (Mniaceae) has not previously been reported from Turkey or SW Asia, according to published checklists of mosses of these regions (Uyar and Çetin 2004; Kürschner and Erdağ 2005; Frey and Kürschner 2011) although it has been recorded from Far East Asia, the Russian Far East, Europe and North America.

Rhizomnium (Broth.) T.J.Kop. (Mniaceae) is represented by three species in SW Asia, two of these (*R. magnifolium* (Horik.) T.J.Kop. and *R. punctatum* (Bruch & Schimp.) T.J.Kop.) have been found in Turkey.

There have been seven taxa of *Leucodon* Schwägr. recorded from Southwest Asia, including four (*L. flagellaris* Lindb. ex Broth., *L. immersus* Lindb., *L. sciuroides* var. *morensis* (Schwägr.) De Not. and *L. sciuroides* var. *sciuroides* (Hedw.) Schwägr. from Turkey.

Three species of *Leucobryum* Hampe (Leucobryaceae) including *L. albidum* (P.Beauv.) Lindb., *L. glaucum* (Hedw.) Ångstr. and *L. juniperoideum* (Brid.) Müll.Hal. have been reported previously from Turkey and SW Asia.

Material and Methods

The moss specimens were collected by the authors during field work in the Black Sea region of northeastern Anatolia (Turkey) from 24–26 October 2013, on the 14th November 2013 and 29th January 2014. Identifications were determined using keys of Ireland (1982), Noguchi and Iwatsuki (1987, 1989), Lin and He (1999), Li et al. (2007) and Zhang and He (2011). The status of these taxa in Turkey and Southwest Asia were evaluated using

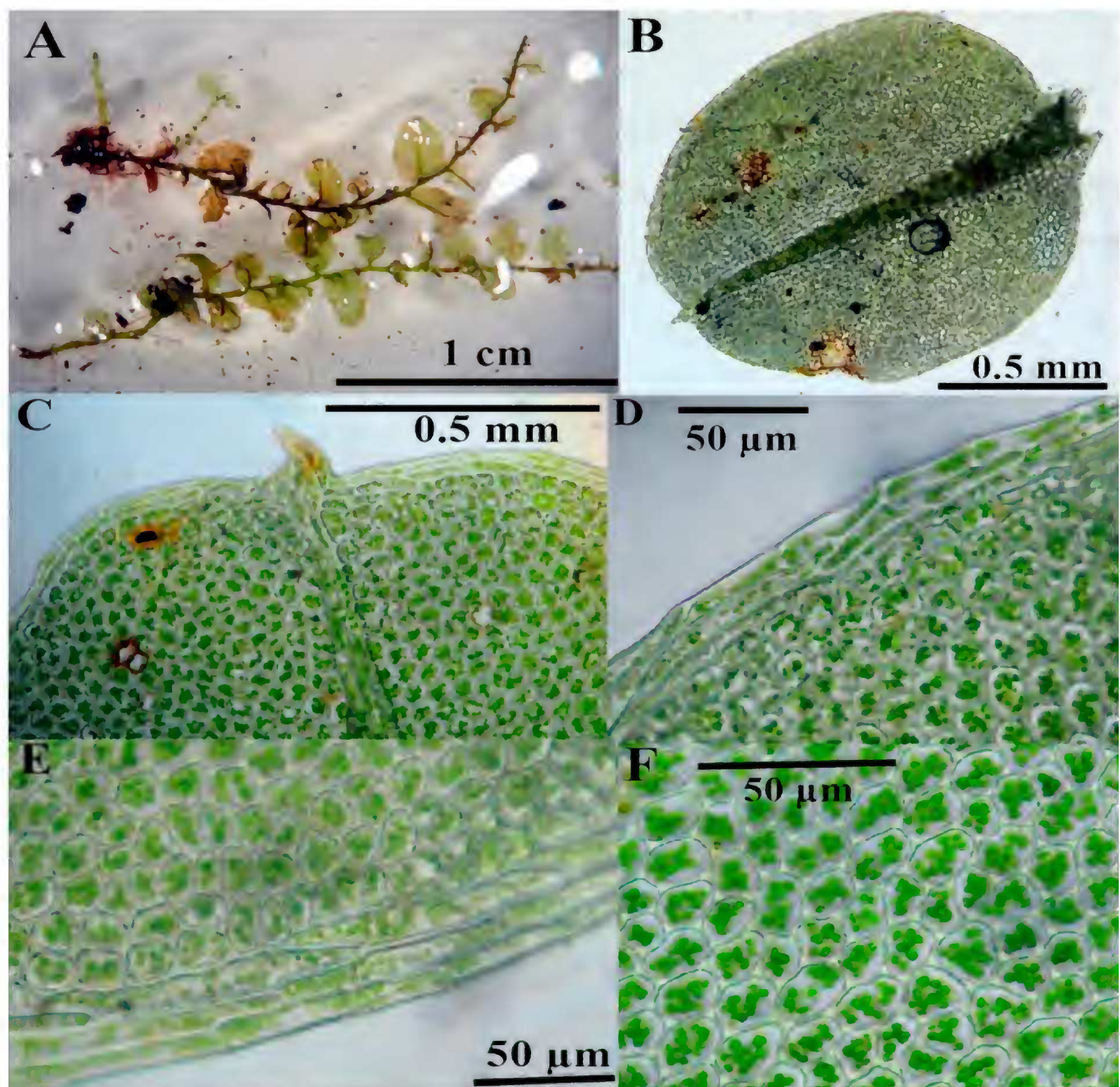


Fig. 2. *Cyrtomnium hymenophylloides*. A. Habit; B. Leaf; C. Leaf apex; D. Marginal cells near apical region; E. Median marginal cells; F. Mid-leaf cells.

Uyar and Çetin (2004), Kürschner and Erdağ (2005), Kürschner and Frey (2011) and Ros et al. (2013). Selected vouchers have been deposited in the Herbarium of the Biology Department, Faculty of Science, Karadeniz Technical University, Turkey (KTUB).

Results

Cyrtomnium hymenophylloides (Hübener) T.J. Kop.

Fig. 2

Specimens examined: TURKEY, Ordu province: Ulubey, Kalıcak Village (Locality 1), 40°49'50"N 37°45'40"E, on wet soil, 195 m, 14 November 2013, N. Batan and T. Ozdemir KTUB1590; Ulubey, Kadıncık Village (Locality 2), 40°52'41"N 37°43'15"E, on wet soil, 540 m, 26 October 2013, N. Batan and T. Ozdemir KTUB1591.

Cyrtomnium is similar to, and easily confused with both *Plagiomnium* and *Rhizomnium*. However, *Cyrtomnium* has entire leaf margins whereas *Plagiomnium* taxa typically have serrulate to serrate leaf margins. *Cyrtomnium hymenophylloides* also resembles *Rhizomnium* taxa, but differs in having ovate leaves with unistratose leaf margins rather than elliptic to obovate leaves with bistratose or multistratose margins. *Cyrtomnium hymenophylloides* grows in loose, erect tufts, with flat, ovate leaves erect to spreading, slightly contorted when dry, with acute to apiculate leaf apices and entire, unistratose margins bordered by 2 or 3 rows of linear, yellowish cells forming a distinct border.

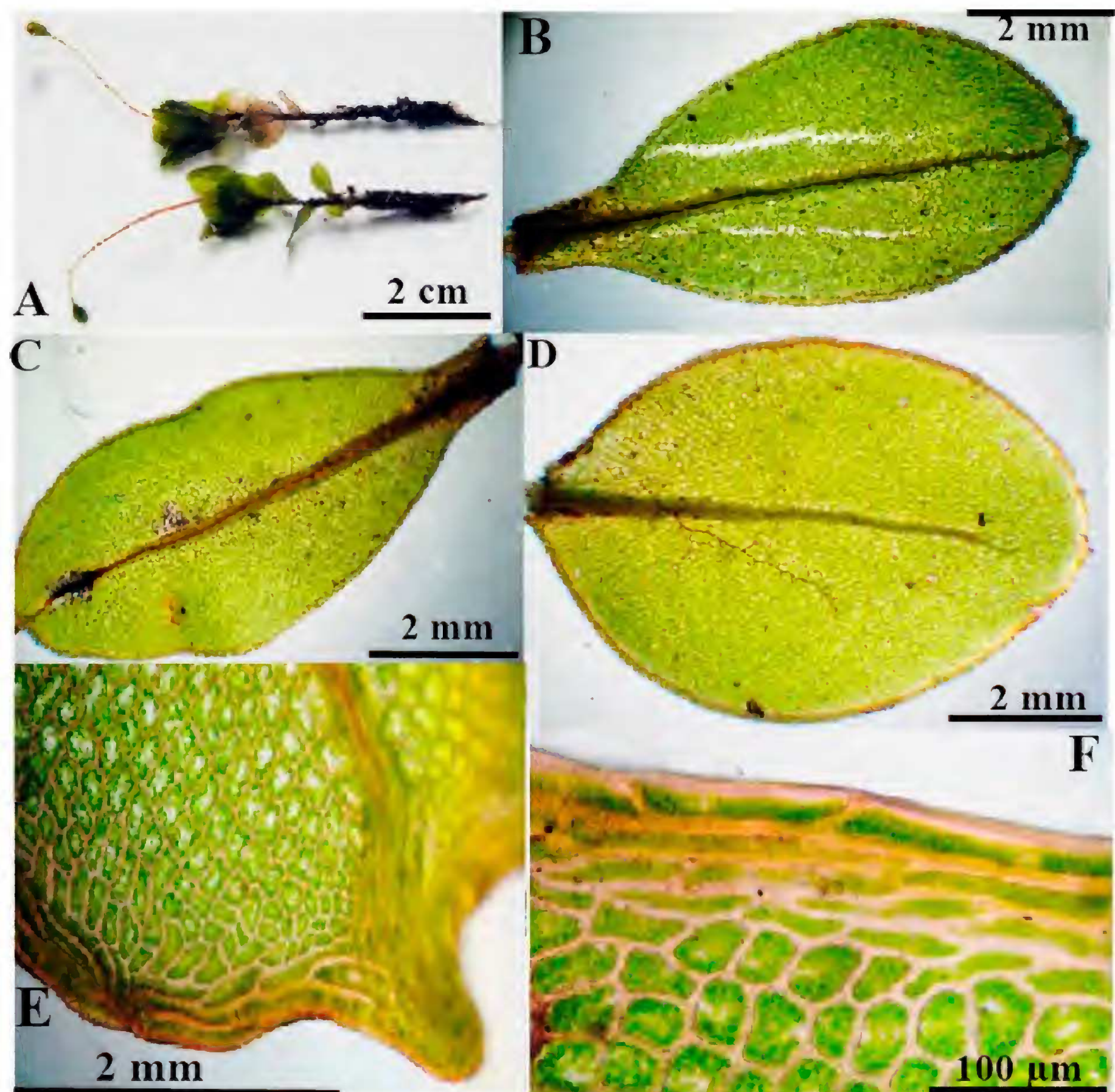


Fig. 3. *Rhizomnium striatulum*. A. Habit; B, C. Perichaetal leaves; D. Stem leaf; E. Leaf apex; F. Median marginal cells.

Distribution: *Cyrtomnium hymenophylloides* is previously known from Asia (China, Japan, Russia), Europe (Bosnia-Herzegovina, Croatia, France, Italy, Macedonia, Montenegro, Romania, Serbia, Slovenia) and North America. This species is new to Turkey and Southwest Asia (Ireland 1982; Uyar and Çetin 2004; Kürschner and Erdağ 2005; Frey et al. 2006; Li et al. 2007; Sabovljević et al. 2008; Kürschner and Frey 2011; Ros et al. 2013).

***Rhizomnium striatulum* (Mitt.) T.J.Kop.**

Fig. 3

Specimen examined: TURKEY, Ordu province: between Tepe Village and Kırılı Village (Locality 3), 41°01'09"N 37°42'11"E, on wet soil, river bank, 690 m, 29 January 2014, N. Batan and T. Ozdemir KTUB1592.

Rhizomnium striatulum typically differs from other *Rhizomnium* species in that its leaves have a much larger apiculus. The leaves are scarcely contorted when dry because of the stout leaf border. *Rhizomnium* is also morphologically close to *Cyrtomnium*, but differs in having bistratose to multistratose leaf borders (Ireland 1982; Noguchi and Iwatsuki 1989; Li et al. 2007).

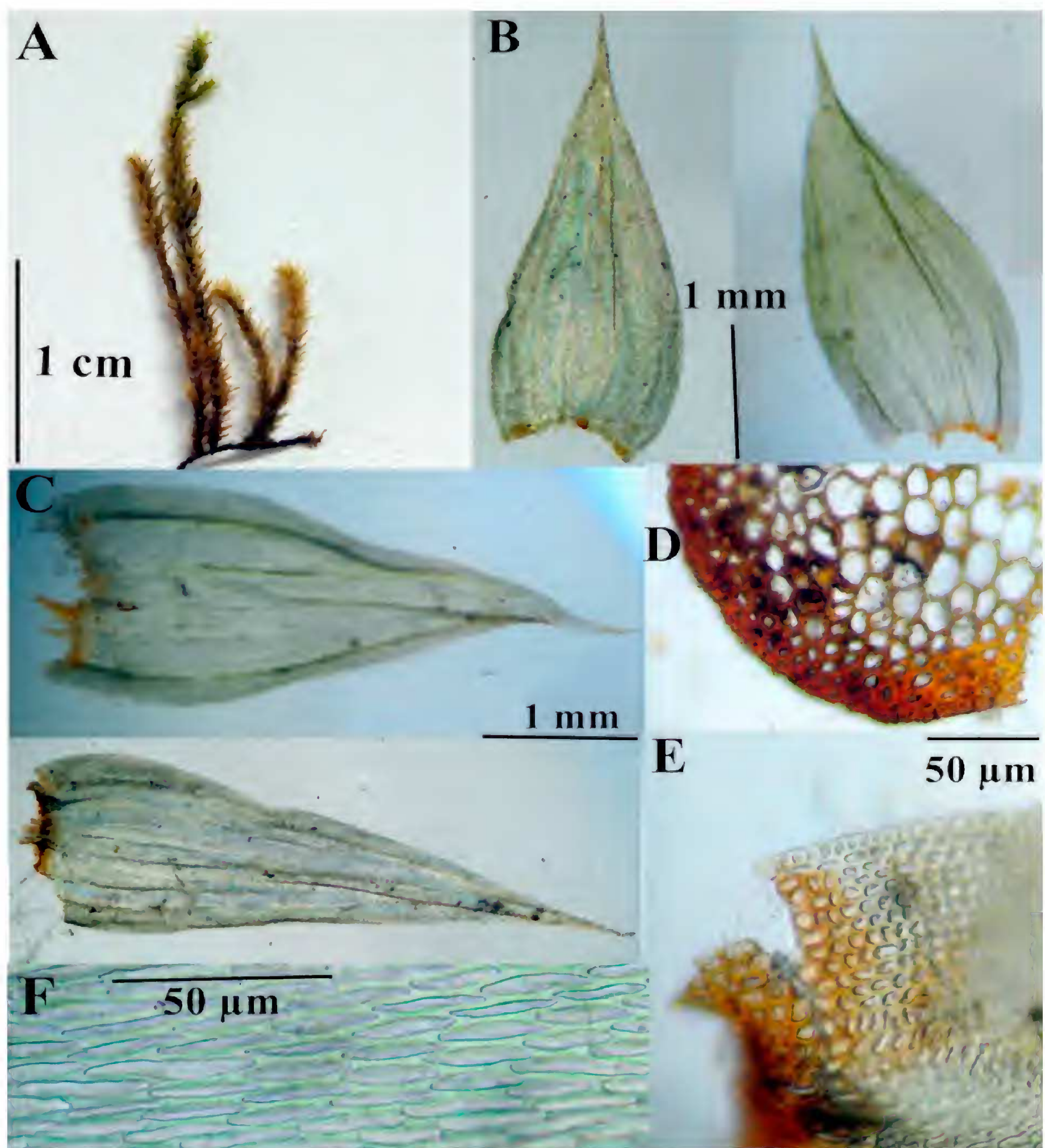


Fig. 4. *Leucodon corensis*. A. Habit; B, C. Leaves; D. Cross-section of stem; E. Leaf base (Basal cells).

Distribution: This species was previously known from China, Taiwan, Japan, Korea, India and Russia (Noguchi and Iwatsuki 1989; Uyar and Çetin 2004; Kürschner and Erdağ 2005; Ignatov et al. 2006; Li et al. 2007; Kürschner and Frey 2011.; Ros et al. 2013). This species is new to Turkey, the Mediterranean and Southwest Asia.

***Leucodon coreensis* Cardot**

Fig. 4

Specimen examined: TURKEY, Ordu province: Ulubey, Şehler village (Locality 4), 40°50'32"N 37°42'35"E, on tree trunk, 522 m, 26 October 2013, N. Batan and T. Ozdemir KTUB1593.

This is the smallest of all the *Leucodon* species and is typically more rigid. The broadly ovate leaves with narrowly acuminate apices are the distinguishing characters of this species.

The stems lack a central strand. The species is also characterized by large perichaetial leaves (Noguchi and Iwatsuki 1989; Zhang and He 2011).

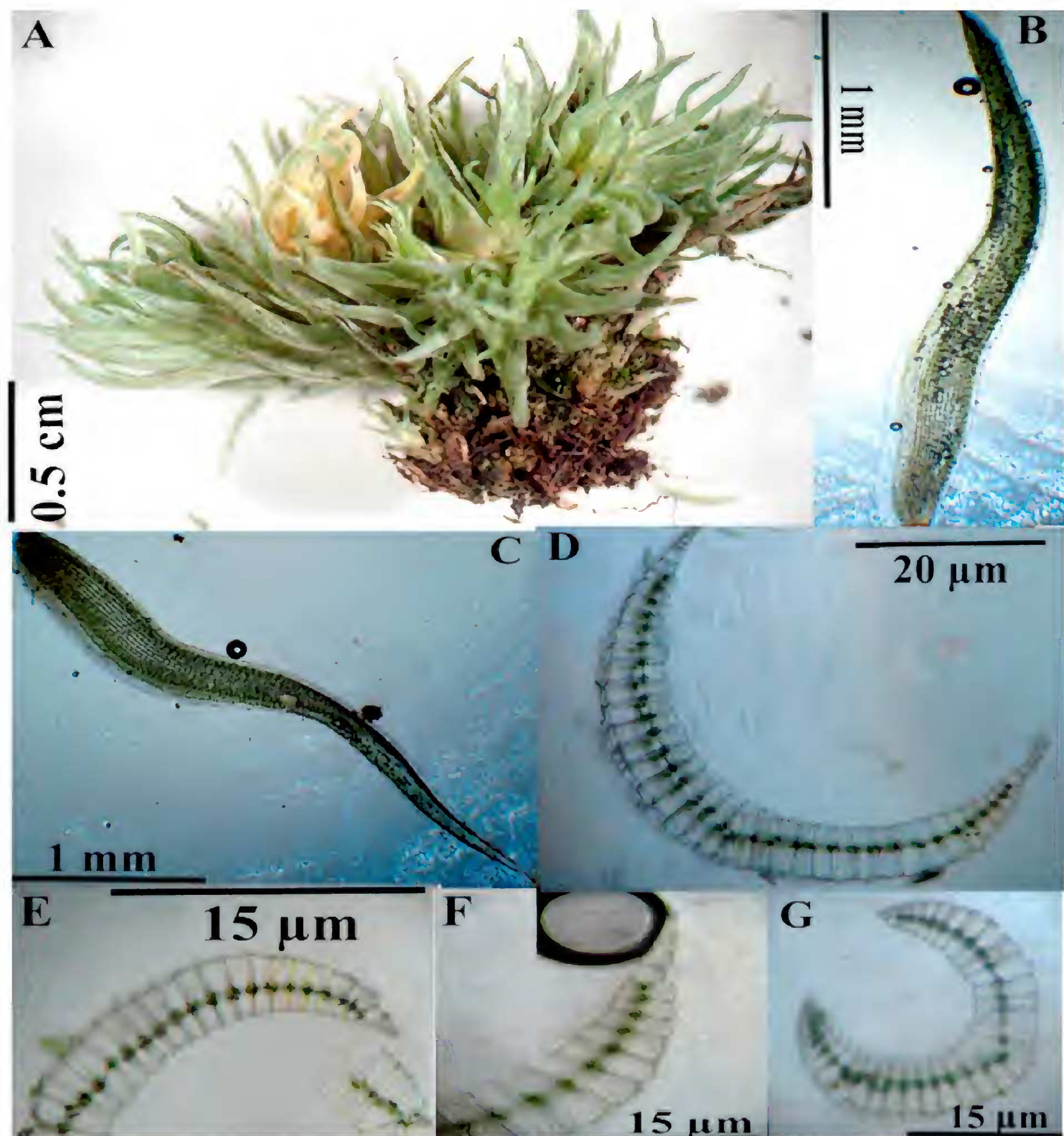


Fig. 5. *Leucobryum bowringii* A. Habit; B, C. Leaves; D–G: Transverse sections of leaf (D–F. near basal part of leaf, E. near mid-leaf, G. near apical region of leaf).

Distribution: *Leucodon coreensis* is previously known from China, Japan and Korea. This species is new to Turkey, Mediterranean and Southwest Asia (Noguchi and Iwatsuki 1989; Uyar and Çetin 2004; Kürschner and Erdağ 2005; Kürschner and Frey 2011; Zhang and He 2011; Ros et al. 2013).

Leucobryum bowringii Mitt.

Fig. 5

Specimen examined: TURKEY, Ordu province: Gülyalı district, Soğukoluk village (Locality 5), 40°56'55"N and 38°02'51"E, on soil, 345 m, 24 October 2013, N. Batan and T. Özdemir KTUB1594.

Leucobryum bowringii is morphologically similar to *L. neilgherrense* Müll.Hal. and *L. scabrum*. It is easily confused with *L. scabrum*, but can be distinguished from that species by its smaller, more slender leaves and the dorsal side of the leaf acumina is smooth. The dorsal side of the leaf acumina of *L. scabrum* is prorate. Plants of *L. bowringii* are much larger than those of *L. neilgherrense*, and the leaves are much longer.

Distribution: This widespread species is known from Mexico, Cuba, Venezuela, Japan, Cambodia, China, Taiwan, Thailand, Vietnam, Indochina, Malaysia, Himalayas, India, Sri Lanka, Philippines, Indonesia, New Guinea and Vanuatu (Noguchi and Iwatsuki 1987; Lim and He 1999; Uyar and Çetin 2004; Kürschner and Erdağ 2005; Kürschner and Frey 2011; Ros et al. 2013). This species is new to Turkey, the Mediterranean and Southwest Asia.

Acknowledgments

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References

- Abay G, Keçeli T (2014) *Sphagnum molle* (Sphagnaceae, Bryophyta) in Turkey and SW Asia. *Cryptogamie, Bryologie* 35: 105–112. <http://dx.doi.org/10.7872/cryb.v35.iss1.2014.105>
- Akman Y (1999) *Climate and bioclimate* (The methods of bioclimate and climate types of Turkey). Kariyer matbaacılık, Ankara (in Turkish).
- Atalay I (1994) *Vegetation geography of Turkey*. İzmir: Ege University Press (in Turkish).
- Batan N, Özdemir T (2013a) Contributions to the moss flora of the Caucasian part (Artvin Province) of Turkey. *Turkish Journal of Botany* 37: 375–388.
- Batan N, Özdemir T (2013b) Contribution to the moss flora of eastern Black Sea region (Artvin) in Turkey and new record to the Southwest Asia. *Arctoa* 22: 101–106.
- Batan N, Alataş M, Özdemir T (2013a) *Leptoscyphus cuneifolius* (Lophocoleaceae, Marchantiophyta) new to Southwest Asia. *Cryptogamie, Bryologie* 34: 373–377. <http://dx.doi.org/10.7872/cryb.v34.iss3.2013.373>
- Batan N, Alataş M, Özdemir T (2013b) *Schistidium sordidum* new to Turkey and Southwest Asia. *Archives of Biological Science* 65: 1505–1509. <http://dx.doi.org/10.2298/ABS1304505B>
- Ignatov MS, Afonina OM, Ignatova EA (2006) Check-list of mosses of East Europe and North Asia. *Arctoa* 15: 1–130.
- Ireland RR (1982) *Moss flora of the maritime provinces*. National Museum of Natural Sciences, Publication in Botany No: 13, Ottawa.
- Kirmaci M, Kürschner H (2013) The genus *Sphagnum* L. in Turkey – with *S. contortum*, *S. fallax*, *S. magellanicum* and *S. rubellum*, new to Turkey and Southwest Asia. *Nova Hedwigia* 96: 383–397. <http://dx.doi.org/10.1127/0029-5035/2013/0079>
- Kürschner H, Erdağ A (2005) Bryophytes of Turkey: an annotated reference list of the species with synonyms from the recent literature and an annotated list of Turkish bryological literature. *Turkish Journal of Botany* 29: 95–154.
- Kürschner H, Frey W (2011) Liverworts, mosses and hornworts of Southwest Asia (Marchantiophyta, Bryophyta, Anthocerotophyta). *Nova Hedwigia* 139: 1–240.
- Li X-J, He S, Zang M (2007) *Moss flora of China* (Mniaceae), English version, Vol. 4. Science Press (Beijing, New York) and Missouri Botanical Garden Press (St. Louis): 93–144.
- Lin B-J, He S (1999) *Moss flora of China* (Leucobryaceae), English version, Vol. 1. Science Press (Beijing, New York) and Missouri Botanical Garden Press (St. Louis): 242–258
- Noguchi A, Iwatsuki Z (1987) *Illustrated moss flora of Japan*, Part 1. The Hattori Botanical Laboratory, Miyazaki.
- Noguchi A, Iwatsuki Z (1989) *Illustrated moss flora of Japan*, Part 3. The Hattori Botanical Laboratory, Miyazaki.
- Sabovljević M, Natcheva R, Gheorghe D, Tsakiri E, Dragičević S, Erdağ A, Papp B (2008) Check-list of the mosses of SE Europe. *Phytologia Balcanica* 14: 207–244.

- Ros RM, Mazimpaka V, Abou-Salama U, Aleffi M, Blockeel TL, Bruges M, Cros RM, Dia MG, Dirkse GM, Draper I, Elsaadawi W, Erdag A, Ganeva A, Gabriel R, Gonzalezmancebo JM, Granger C, Herrstadt I, Hugonnot V, Khalil K, Kürschner H, Losada-Lima A, Luis L, Mifsud S, Privitera M, Puglisi M, Sabovljević M, Sergio C, Shabbara HM, Sim-Sim M, Sotiaux A, Tacchi R, Vanderpoorten A, Werner O (2013) Mosses of the Mediterranean, an annotated checklist. *Cryptogamie, Bryologie* 34: 99–283. <http://dx.doi.org/10.7872/cryb.v34.iss2.2013.99>
- Uyar G, Çetin B (2004) A new check-list of the mosses of Turkey. *Journal of Bryology* 26: 203–220. <http://dx.doi.org/10.1179/037366804X5305>
- Uyar G, Ören M (2013) Three remarkable new moss records for South-West Asia from northern Turkey. *Turkish Journal of Botany* 37: 363–368.
- Yayıntaş ÖT (2013) New national and regional bryophyte records, 36. *Neckera pennata* Hedw. Turkey. *Journal of Bryology* 35: 233.
- Zhang M-X, He S (2011) *Moss flora of China* (Leucodontaceae), English version, Vol. 5, Science Press (Beijing, New York) and Missouri Botanical Garden Press (St. Louis): 153–181.

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